

## C L A I M S

1. A gas laser comprising:

an annular optical cavity defined by a pair of coaxial spaced electrodes which produces an annular coherent beam of a first diameter and a first thickness;

a mirror structure located at one end of the annular optical cavity and including:

a first mirror surface which is operative to decrease the diameter of the annular coherent beam from said first diameter and to expand the thickness of the annular coherent beam from said first thickness;

a second mirror surface which is operative to focus a beam reflected by said first mirror surface to a location located interiorly of said pair of coaxial spaced electrodes;

a third mirror surface located at an opposite end of the annular optical cavity; and

an output coupler operative to receive, reflect and transmit a beam reflected by said second mirror surface.

2. A laser according to claim 1 and wherein said first mirror surface is an off-axis parabolic rotationally symmetric surface.

3. A laser according to claim 1 or claim 2 and wherein said second mirror surface is an off-axis ellipsoidal rotationally symmetric surface.

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4. A gas laser according to any of claims 1 - 3 and where-  
in:

    said annular optical cavity is defined by inner and  
    outer coaxial spaced electrodes which produces an annular coher-  
    ent beam; and

    said gas laser also comprises an RF power supply cou-  
    pled to said outer electrode at at least one location symmetrical  
    with respect to the length thereof.

5. A gas laser according to claim 4 and wherein the inner  
electrode is grounded.

6. A gas laser according to claim 4 or claim 5 and com-  
prising a grounded structure surrounding the annular optical  
cavity.

7. A gas laser according to claim 6 and wherein first and  
second ends of said outer electrode are coupled to said grounded  
structure via a plurality of induction coils.

8. A gas laser according to claim 4 and wherein said at  
least one location is a location centered with respect to the  
length of said outer electrode.

9. A gas laser according to any of the preceding claims  
and wherein said mirror structure is grounded.

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10. A gas laser comprising:

an annular optical cavity defined by inner and outer coaxial spaced electrodes which produces an annular coherent beam; and

an RF power supply coupled to said outer electrode at at least one location symmetrical with respect to the length thereof.

11. A gas laser according to claim 10 and wherein the inner electrode is grounded.

12. A gas laser according to claim 10 or claim 11 and comprising a grounded structure surrounding the annular optical cavity.

13. A gas laser according to claim 12 and wherein first and second ends of said outer electrode are coupled to said grounded structure via a plurality of induction coils.

14. A gas laser according to claim 10 and wherein said at least one location is a location centered with respect to the length of said outer electrode.

15. A gas laser according to any of claims 10 - 14 and also comprising:

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a grounded structure surrounding the annular optical cavity and including first and second portions having precisely formed first and second mating surfaces,

said first portion having machined thereon a first mirror structure located at one end of the annular optical cavity; and

said second portion having machined thereon a second mirror structure located at one end of the annular optical cavity.

16. A gas laser according to claim 15 and wherein said first mating surface and said first mirror structure are machined together so as to ensure desired alignment therebetween.

17. A gas laser according to claim 15 or claim 16 and wherein said second mating surface and said second mirror structure are machined together so as to ensure desired alignment therebetween.

18. A gas laser according to any of claims 15 - 17 and wherein said first mirror structure comprises:

a first mirror surface which is operative to decrease the diameter of the annular coherent beam from said first diameter and to expand the thickness of the annular coherent beam from said first thickness;

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a second mirror surface which is operative to focus an annular beam reflected by said first mirror surface to a location located interior of said pair of coaxial spaced electrodes; and

a spatial filter disposed at said location located interior of said pair of coaxial spaced electrodes.

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19. A gas laser according to claim 18 and wherein said second mirror structure comprises:

a third mirror surface located at an opposite end of the annular optical cavity.

20. A gas laser according to any of claims 15-19 and also comprising an output coupler.

21. A gas laser comprising:

an annular optical cavity defined by inner and outer coaxial spaced electrodes which produces an annular coherent beam;

a grounded structure surrounding the annular optical cavity and including first and second portions having precisely formed first and second mating surfaces,

said first portion having machined thereon a first mirror structure located at one end of the annular optical cavity; and

said second portion having machined thereon a second

mirror structure located at one end of the annular optical cavity.

22. A gas laser according to claim 21 and wherein said first mating surface and said first mirror structure are machined together so as to ensure desired alignment therebetween.

Sub AS 23. A gas laser according to claim 21 or claim 22 and wherein said second mating surface and said second mirror structure are machined together so as to ensure desired alignment therebetween.

24. A gas laser according to any of claims 21 - 23 and wherein said first mirror structure comprises:

a first mirror surface which is operative to decrease the diameter of the annular coherent beam from said first diameter and to expand the thickness of the annular coherent beam from said first thickness;

a second mirror surface which is operative to focus an annular beam reflected by said first mirror surface to a location located interior of said pair of coaxial spaced electrodes; and

a spatial filter disposed at said location located interior of said pair of coaxial spaced electrodes.

25. A gas laser according to claim 24 and wherein said second mirror structure comprises:

a third mirror surface located at an opposite end of

the annular optical cavity.

**Sub A9** 26. A gas laser according to any of claims 19 - 23 and also comprising an output coupler.

27. A gas laser comprising:

an enclosure;

an annular optical cavity defined by inner and outer coaxial spaced electrodes disposed within said enclosure and which produces an annular coherent beam; and

a plurality of RF power supplies mounted onto said enclosure and coupled to said outer electrode at multiple locations thereon distributed along the length and circumference thereof, thereby to provide generally homogeneous power and voltage distribution throughout said cavity.

28. A gas laser according to claim 27 and wherein the inner electrode is grounded.

**Sub A10** 29. A gas laser according to claim 27 or claim 28 and comprising a grounded structure surrounding the annular optical cavity.

30. A gas laser according to claim 29 and wherein first and second ends of said outer electrode are coupled to said grounded structure via a plurality of induction coils.

**Sub A11** 31. A gas laser according to any of claims 27 - 30 and also

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comprising:

a grounded structure surrounding the annular optical cavity and including first and second portions having precisely formed first and second mating surfaces,

said first portion having machined thereon a first mirror structure located at one end of the annular optical cavity; and

said second portion having machined thereon a second mirror structure located at one end of the annular optical cavity.

32. A gas laser according to claim 31 and wherein said first mating surface and said first mirror structure are machined together so as to ensure desired alignment therebetween.

33. A gas laser according to claim 30 or claim 31 and wherein said second mating surface and said second mirror structure are machined together so as to ensure desired alignment therebetween.

34. A gas laser according to any of claims 30 - 33 and wherein said first mirror structure comprises:

a first mirror surface which is operative to decrease the diameter of the annular coherent beam from said first diameter and to expand the thickness of the annular coherent beam from said first thickness;

a second mirror surface which is operative to

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Conc. focus an annular beam reflected by said first mirror surface to a location located interior of said pair of coaxial spaced electrodes; and  
a spatial filter disposed at said location located interior of said pair of coaxial spaced electrodes.

35. A gas laser according to claim 34 and wherein said second mirror structure comprises:

a third mirror surface located at an opposite end of the annular optical cavity.

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36. A gas laser according to any of claims 31 - 35 and also comprising an output coupler.